

Application No. 10/798,775
Response to Office Action

Customer No. 01933

Listing of Claims:

1. (Currently Amended) An illumination switching apparatus comprising:

an objective having a numerical aperture which enables total reflection illumination to be performed on a target;

5 a light source section which has a light source optical axis and outputs illumination light;

an illumination system which has an illumination system optical axis and guides ~~receives~~ the illumination light output from the light source section ~~and guides it~~ to the objective; and

10 an illumination switching section which selects one of a first optical path and a second optical path, wherein when the first optical path is selected, the light source optical axis coincides with the illumination optical axis, and the illumination light output from the light source section ~~being~~

15 is guided through the illumination system to ~~transmit~~ travel along an optical axis of the objective ~~and to~~ illuminate the target in a standard observation mode, and wherein when the second optical path is selected, the light source optical axis is offset with respect to the illumination optical axis, and the

20 illumination light output from the light source section ~~being~~ is guided through the illumination system and the objective to illuminate the target in a total reflection observation mode.

Application No. 10/798,775
Response to Office Action

Customer No. 01933

2. (Currently Amended) The illumination switching apparatus according to claim 1, wherein the illumination switching section ~~switches~~ performs switching between illumination of the target using standard observation light, performed by guiding the illumination light through the first optical path, and illumination of the target using total reflection observation light, performed by guiding the illumination light through the second optical path.

3. (Currently Amended) The illumination switching apparatus according to claim 1, wherein ~~[[:]]~~ the light source section includes at least ~~two light sources~~ a first light source and a second light source; and

wherein the illumination switching section includes:
a light transmission section which guides the illumination light output from ~~one of the~~ first light sources source to the first optical path, and guides the illumination light output from ~~the other of the~~ second light sources source to the second optical path; and

at least two shutter mechanisms including a first shutter mechanism provided across the first optical path and a second shutter mechanism provided across the second optical path,

Application No. 10/798,775
Response to Office Action

Customer No. 01933

15 ~~wherein~~ the at least two shutter mechanisms ~~cooperating~~
~~cooperate to allow selectively permit~~ the illumination light to
~~transmit travel~~ through one of the first and the second optical
~~path, and to interrupt paths while preventing~~ the illumination
~~light to transmit from traveling~~ through the other of the first
and the second optical ~~path paths~~.

4. (Currently Amended) The illumination switching apparatus
according to claim 3, wherein:

5 ~~each of the first and second~~ light sources ~~have respective~~
~~comprises a laser oscillators oscillator~~ which ~~output outputs a~~
respective laser beams ~~beam~~; and

the shutter mechanisms are attached to ~~the~~ respective output
terminals of the laser oscillators.

5 5. (Currently Amended) The illumination switching apparatus
according to claim 3, wherein ~~each of~~ the shutter mechanisms ~~have~~
~~respective comprises one of a~~ mechanical ~~shutters shutter~~ which
~~are is~~ mechanically opened and closed, ~~or respective and an~~
electronic ~~shutters shutter~~ which ~~are is~~ electronically opened
and closed.

6. (Currently Amended) The illumination switching apparatus
according to claim 3, further comprising a shutter controller

Application No. 10/798,775
Response to Office Action

Customer No. 01933

which opens ~~one of the first~~ shutter mechanisms mechanism and
closes the ~~other second~~ shutter mechanism when the target is
5 observed using standard fluorescent light, ~~the shutter controller~~
~~closing the one and which closes the first~~ shutter mechanism and
~~opening the other~~ opens the second shutter mechanism when the
target is observed using total reflection of fluorescent light.

7. (Currently Amended) An illumination switching apparatus
comprising:

an objective having a numerical aperture which enables total
reflection illumination to be performed on a target;

5 a first light source which outputs first illumination light;
at least one second light source which outputs second
illumination light;

an illumination system which ~~receives~~ has an illumination
optical axis and guides a received one of the first or and second
10 illumination light and guides it to the objective;

a first light transmission section which guides the first
illumination light ~~[[,]]~~ output from the first light source ~~[[,]]~~
to a first optical path, which has an optical axis that coincides
with the illumination optical axis and along which the first
15 illumination light is guided through the first optical path being
~~formed in the illumination system to guide the first illumination~~
~~light and~~ along an optical axis of the objective;

Application No. 10/798,775
Response to Office Action

Customer No. 01933

20 a second light transmission section which guides the second illumination light ~~[[,]]~~ output from the second light source ~~[[,]]~~ to a second optical path, which has an optical axis that is offset with respect to the illumination optical axis and along which the second illumination light is guided through the second optical path being formed in the illumination system to realize the total reflection illumination on the target;

25 a first illumination switching section which ~~allows is~~ selectively operable to permit the first illumination light output from the first light source to be guided to the first light transmission section, ~~or interrupts~~ and to interrupt the first illumination light; and

30 a second illumination switching section which ~~allows is~~ selectively operable to permit the second illumination light output from the second light source to be guided to the second light transmission section, ~~or interrupts~~ and to interrupt the second illumination light.

8. (Currently Amended) The illumination switching apparatus according to claim 7, wherein: ~~[[;]]~~

5 the first illumination switching section ~~has~~ comprises a first shutter mechanism which ~~allows is~~ selectively operable to permit the first illumination light output from the first light

Application No. 10/798,775
Response to Office Action

Customer No. 01933

source to be guided to the first light transmission section, ~~or~~
~~interrupts and to interrupt~~ the first illumination light; and

the second illumination switching section ~~has~~ comprises a
second shutter mechanism which ~~allows~~ is selectively operable to
10 permit the second illumination light output from the second light
source to be guided to the second light transmission section, ~~or~~
~~interrupts and to interrupt~~ the second illumination light.

9. (Currently Amended) The illumination switching apparatus
according to claim 8, wherein:

each of the first and the second light ~~source have~~
respective sources comprises a laser oscillators oscillator which
5 output outputs a respective laser ~~beams beam~~; and

the first and the second shutter mechanism are attached to
the respective output terminals of the laser oscillators.

10. (Currently Amended) The illumination switching
apparatus according to claim 9, wherein each of the first and the
second shutter mechanism ~~have respective~~ comprises one of a
mechanical ~~shutters shutter~~ which ~~are~~ is mechanically opened and
5 closed, ~~or respective and an~~ electronic ~~shutters shutter~~ which
~~are~~ is electronically opened and closed.

Application No. 10/798,775
Response to Office Action

Customer No. 01933

11. (Currently Amended) The illumination switching apparatus according to claim 9, further comprising a shutter controller which opens the first shutter mechanism and closes the second shutter mechanism in a standard illumination observation mode, ~~the shutter controller closing~~ and which closes the first shutter mechanism and ~~opening~~ opens the second shutter mechanism in a total reflection illumination observation mode.

12. (Currently Amended) The illumination switching apparatus according to claim 9, wherein the respective laser beams output by the laser oscillators ~~output laser beams of~~ have different wavelengths.

13. (Currently Amended) The illumination switching apparatus according to claim 7, wherein the first light transmission section includes a first optical fiber which transmits the first illumination light, and a first light emission section which guides the first illumination light, which has been transmitted ~~from~~ through the first optical fiber, to the first optical path ~~of the illumination system~~.

14. (Currently Amended) The illumination switching apparatus according to claim 7, wherein the second light transmission section includes a second optical fiber which

Application No. 10/798,775
Response to Office Action

Customer No. 01933

transmits the second illumination light, a second light emission
5 section which outputs the second illumination light, which has
been transmitted ~~from~~ through the second optical fiber, and an
optical element which deflects the second illumination light
output from the second light emission section, thereby guiding
the second illumination light to the second optical path ~~of the~~
10 ~~illumination system.~~

15. (Currently Amended) The illumination switching
apparatus according to claim 14, wherein the optical element ~~has~~
comprises a small total reflection mirror.

16. (Currently Amended) The illumination switching
apparatus according to claim 14, wherein the optical element ~~has~~
comprises a total reflection microprism.

17. (Withdrawn - Currently Amended) The illumination
switching apparatus according to claim 7, wherein the first light
transmission section includes a first optical fiber which
transmits the first illumination light, a first light emission
5 section which outputs the first illumination light, that has been
transmitted ~~from~~ through the first optical fiber, and an optical
element which deflects the first illumination light output from
the first light emission section, thereby guiding the first

Application No. 10/798,775
Response to Office Action

Customer No. 01933

illumination light to the first optical path ~~of the illumination~~
10 ~~system.~~

18. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 17, wherein the optical element ~~has~~ comprises a small total reflection mirror.

19. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 17, wherein the optical element ~~has~~ comprises a total reflection microprism.

20. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 7, wherein the second light transmission section includes a second optical fiber which transmits the first illumination light, and a second light
5 emission section which guides the second illumination light, that has been transmitted ~~from through~~ the second optical fiber, to the second optical path ~~of the illumination system.~~

21. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 14, wherein the second light emission section and the optical element are integrally movable in a direction parallel to ~~an~~ the illumination optical axis of the illumination system.

Application No. 10/798,775
Response to Office Action

Customer No. 01933

22. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 21, wherein the optical element ~~has~~ comprises a small total reflection mirror.

23. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 21, wherein the optical element ~~has~~ comprises a total reflection microprism.

24. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 20, wherein the second light emission section is movable in a direction perpendicular to ~~an~~ the illumination optical axis of the illumination system.

25. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 1, wherein ~~[[:]]~~ the light source section ~~has~~ comprises a laser oscillator which ~~output~~ outputs a laser beam; and

5 wherein the illumination switching section includes:

 a beam splitter which branches the laser beam, that is output from the laser oscillator, in two directions;

 a first shutter mechanism and a second shutter mechanism provided at respective branched optical paths of the
10 beam splitter;

Application No. 10/798,775
Response to Office Action

Customer No. 01933

a first light transmission section which guides the illumination light, ~~having that has~~ passed through the first shutter mechanism, to ~~a the~~ first optical path; ~~formed in the illumination system;~~ and

15 a second light transmission section which guides the illumination light, ~~having that has~~ passed through the second shutter mechanism, to ~~a the~~ second optical path. ~~formed in the illumination system.~~

26. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 25, wherein the beam splitter is provided at ~~the a~~ laser output terminal of the laser oscillator, and the first shutter mechanism and the second shutter mechanism are provided close to the beam splitter.

27. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 25, further comprising a plurality of wavelength converting sections provided across ~~the~~ respective branched optical paths of the beam splitter for
5 converting a wavelength of the laser beam into a desired value.

28. (Withdrawn - Currently Amended) The illumination switching apparatus according to claim 25, wherein the laser

Application No. 10/798,775
Response to Office Action

Customer No. 01933

oscillator outputs a plurality of laser beams ~~of having~~ different wavelengths.

29. (Currently Amended) An illumination switching apparatus comprising:

an objective having a numerical aperture which enables total reflection illumination to be performed on a target;

5 a first laser oscillator which outputs a first laser beam;

a second laser oscillator which outputs a second laser beam;

an illumination system which ~~receives~~ guides a received one
of the first or and second laser beam, and guides it beams to the objective;

10 a first shutter mechanism provided at a laser output terminal of the first laser oscillator;

a second shutter mechanism provided at a laser output terminal of the second laser oscillator;

15 a first optical fiber which transmits the first laser beam having that has passed through the first shutter mechanism;

a first laser emission section which emits the first laser beam transmitted through the first optical fiber;

20 a total reflection microprism provided across a first optical path formed in the illumination system for guiding light along an optical axis of the objective, the total reflection microprism reflecting the first laser beam, which has been

Application No. 10/798,775
Response to Office Action

Customer No. 01933

emitted from the first laser emission section, such that the first laser beam ~~transmits through~~ travels along the first optical path;

25 a second optical fiber which transmits the second laser beam ~~having that has~~ passed through the second shutter mechanism;

a second laser emission section provided across a second optical path formed in the illumination system for illuminating the target using total reflection of light, the second laser
30 emission section guiding the ~~first~~ second laser beam, transmitted through the second optical fiber, to the second optical path; and

a shutter controller which opens the first shutter mechanism and closes the second shutter mechanism in a standard illumination observation mode for observing the target, the
35 ~~shutter controller closing and which closes~~ the first shutter mechanism and ~~opening~~ opens the second shutter mechanism in a total reflection illumination observation mode for observing the target.

30. (Currently Amended) An illumination switching method comprising:

selectively causing a first shutter mechanism provided at a laser output terminal of a first laser oscillator to permit
5 to pass therethrough or interrupt a first laser beam output from the first laser oscillator;

Application No. 10/798,775
Response to Office Action

Customer No. 01933

10 selectively causing a second shutter mechanism provided at a laser output terminal of a second laser oscillator to permit to pass therethrough or interrupt a second laser beam output from the second laser oscillator;

15 guiding the first laser beam, ~~having~~ which has passed through the first shutter mechanism, along an optical axis of an objective via an illumination system, ~~thereby illuminating to~~ illuminate a target by standard observation fluorescent light; and

20 guiding the second laser beam, ~~having~~ which has passed through the second shutter mechanism, through the objective via the illumination system, ~~thereby illuminating to~~ illuminate the target using total reflection of observation fluorescent light.

20

31. (New) An illumination switching apparatus comprising:

an objective having a numerical aperture which enables total reflection illumination to be performed on a target;

5 at least two light sources including a first light source that comprises a laser oscillator and a second light source that comprises a laser oscillator;

10 at least two shutter mechanisms, which include a first shutter mechanism provided across an optical path of a first laser beam emitted by the first light source and a second shutter mechanism provided across an optical path of a second laser beam

Application No. 10/798,775
Response to Office Action

Customer No. 01933

emitted by the second light source, and which cooperate to selectively permit the laser beam emitted by one of the light sources to be passed therethrough while interrupting the laser beam emitted from another of the light sources;

15 an illumination system which guides a received one of the laser beams output from the at least two light sources to the objective; and

an illumination switching section which selects one of a first optical path and a second optical path, wherein when the
20 first optical path is selected, the first laser beam output from the first light source is guided through the illumination system to travel along an optical axis of the objective to illuminate the target in a standard observation mode, and wherein when the second optical path is selected, the second laser beam output
25 from the second light source is guided through the illumination system and the objective to illuminate the target in a total reflection observation mode.

32. (New) An illumination switching apparatus comprising:
an objective having a numerical aperture which enables total reflection illumination to be performed on a target;

a first light source including a first laser oscillator
5 which outputs a first laser beam;

Application No. 10/798,775
Response to Office Action

Customer No. 01933

at least one second light source including a second laser oscillator which outputs a second laser beam;

an illumination system which guides a received one of the first and second laser beams to the objective;

10 a first light transmission section which guides the first laser beam, that is output from the first light source, to a first optical path along which the first laser beam is guided through the illumination system and along an optical axis of the objective;

15 a second light transmission section which guides the second laser beam, that is output from the second light source, to a second optical path, along which the second laser beam is guided through the illumination system to realize the total reflection illumination on the target;

20 a first illumination switching section which includes a first shutter mechanism provided at a laser output terminal of the first laser oscillator, and which is selectively operable to permit the first laser beam output from the first laser oscillator to be guided to the first light transmission section,
25 and to interrupt the first laser beam; and

a second illumination switching section which includes a second shutter mechanism provided at a laser output terminal of the second laser oscillator, and which is selectively operable to

Application No. 10/798,775
Response to Office Action

Customer No. 01933

permit the second laser beam output from the second light source to be guided to the second light transmission section.

33. (New) An illumination switching apparatus comprising:
an objective having a numerical aperture which enables total reflection illumination to be performed on a target;
a first laser oscillator which outputs a first laser beam;
5 a second laser oscillator which outputs a second laser beam;
an illumination system which guides a received one of the first and second laser beams to the objective;
a first shutter mechanism which is selectively operable to pass therethrough and interrupt the first laser beam;
10 a second shutter mechanism which is selectively operable to pass therethrough and interrupt the second laser beam;
a first optical fiber which transmits the first laser beam that has passed through the first shutter mechanism;
a first laser emission section which emits the first laser
15 beam transmitted through the first optical fiber;
a total reflection microprism provided across a first optical path formed in the illumination system for guiding light along an optical axis of the objective, the total reflection microprism reflecting the first laser beam, which has been
20 emitted from the first laser emission section, such that the first laser beam travels through the first optical path;

Application No. 10/798,775
Response to Office Action

Customer No. 01933

a second optical fiber which transmits the second laser beam that has passed through the second shutter mechanism;

25 a second laser emission section provided across a second optical path formed in the illumination system for illuminating the target using total reflection of light, the second laser emission section guiding the second laser beam, transmitted through the second optical fiber, to the second optical path; and

30 a shutter controller which opens the first shutter mechanism and closes the second shutter mechanism in a standard illumination observation mode for observing the target, and which closes the first shutter mechanism and opens the second shutter mechanism in a total reflection illumination observation mode for observing the target.

34. (New) An illumination switching method comprising:

selectively causing a first shutter mechanism to permit to pass therethrough or interrupt a first laser beam output from a first laser oscillator;

5 selectively causing a second shutter mechanism to permit to pass therethrough or interrupt a second laser beam output from a second laser oscillator;

guiding the first laser beam, which has passed through the first shutter mechanism, along an optical axis of an objective

Application No. 10/798,775
Response to Office Action

Customer No. 01933

10 via an illumination system, to illuminate a target by standard
observation fluorescent light; and

guiding the second laser beam, which has passed through the
second shutter mechanism, through the objective via the
illumination system, to illuminate the target using total
15 reflection of observation fluorescent light.

35. (New) An illumination switching apparatus comprising:
an objective having a numerical aperture which enables total
reflection illumination to be performed on a target;

a light source section which has a light source optical axis
5 and outputs illumination light;

a telecentric illumination system which has an illumination
system optical axis and guides the illumination light output from
the light source section to the objective; and

an illumination switching section which selects one of a
10 first optical path and a second optical path, wherein when the
first optical path is selected, the light source optical axis
coincides with the illumination optical axis, and the
illumination light output from the light source section is guided
through the telecentric illumination system to travel along an
15 optical axis of the objective to illuminate the target in a
standard observation mode, and wherein when the second optical
path is selected, the light source optical axis is offset with

Application No. 10/798,775
Response to Office Action

Customer No. 01933

20 respect to the illumination optical axis, and the illumination
light output from the light source section is guided through the
telecentric illumination system and the objective to illuminate
the target in a total reflection observation mode.

36. (New) An illumination switching apparatus comprising:
an objective having a numerical aperture which enables total
reflection illumination to be performed on a target;

5 a first light source which outputs first illumination light;
at least one second light source which outputs second
illumination light;

a telecentric illumination system which has an illumination
optical axis and guides a received one of the first and second
illumination light to the objective;

10 a first light transmission section which guides the first
illumination light output from the first light source to a first
optical path, which has an optical axis that coincides with the
illumination optical axis and along which the first illumination
light is guided through the telecentric illumination system
15 and along an optical axis of the objective;

a second light transmission section which guides the second
illumination light output from the second light source to a
second optical path, which has an optical axis that is offset
with respect to the illumination optical axis and along which the

Application No. 10/798,775
Response to Office Action

Customer No. 01933

20 second illumination light is guided through the telecentric
illumination system to realize the total reflection illumination
on the target;

a first illumination switching section which is selectively
operable to permit the first illumination light output from the
25 first light source to be guided to the first light transmission
section, and to interrupt the first illumination light; and

a second illumination switching section which is selectively
operable to permit the second illumination light output from the
second light source to be guided to the second light transmission
30 section, and to interrupt the second illumination light.